We claim:

1. An electroplating device for the metallization of wafers for interconnection. The wafer, previously coated with a thin barrier layer and a thin seed layer of the electroplated metal, is placed and pressed against contact fingers or a ring and rested on an insulating ring which masks the circumference edge of the wafer. The wafer is rotated or is held stationary with respect to the plating bath. The electrolyte is pumped upward against the wafer. A plating uniformity parameter is defined:

$$B^2 = (\rho/\rho_{el})(R^2/Wd)$$

where ρ and ρ_{el} are the resistivities of the electroplated metal and the electrolyte, respectively, R is the radius of the wafer, W is the thickness of the electroplated metal and d is the distance between the wafer and the counter electrode. In order to ensure uniformity during electroplating, the electroplating system must obey that the value of B^2 is smaller than unity: $B^2 \leq 1$. This implies that the geometry of the electroplating device is such that the square of the wafer radius divided by the product of the width of the seed layer and the distance between the wafer and the counter electrode must be smaller than the ratio of the resistivities of the electrolyte and the electroplated metal:

$$R^2 / Wd \leq \rho_{el} / \rho$$

2. An electroplating device for wafer metallization as set forth in claim 1, wherein the resistance of the electrolyte is increased by placing a non-conducting porous separator, a distributor or a porous membrane between the wafer and the counter electrode, thus increasing the ionic resistance of the electrolyte and ensuring uniform electroplating.

3. An electroplating device for wafer metallization as set forth in claim 1, wherein the electrochemical resistance is increased by adding leveling agents to the electrolyte which tend to adsorb at the electroplated metal, thus increasing the charge transfer resistance at the metal/electrolyte interface and ensuring uniform and conformal electroplating.

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4. An electroplating device for wafer metallization as set forth in claim 1, wherein the distance between the wafer and the counter electrode d is increased in order to reduce the value of the uniformity parameter B, thus ensuring uniform electroplating.

5. An electroplating device for wafer metallization as set forth in claim 1, wherein the thickness of the seed layer W is increased in order to decrease the uniformity parameter B and to ensure uniform electroplating over the entire wafer.

6. An electroplating device for wafer metallization as set forth in claims 1, wherein the diameter of the counter electrode is smaller than the diameter of the wafer.

7. An electroplating device for wafer metallization as set forth in claims 1 wherein a rotating distributor is placed in front of the wafer. The distributor is rotating by the flow of electrolyte through some of the holes that are drilled in an angle to the flow direction. The electrolyte emerges from the distributor in the form of multiple submerged jets hitting the face of the wafer, thus ensuring uniformity and conformity, in the presence or even in the absence of electroplating additives such as leveling agents and brighteners. Uniform or predetermined nonuniform distribution of electroplating can be achieved by uniform or nonuniform distribution of holes in the distributor, respectively.

8. An electroplating device for wafer metallization as set forth in claims 1 wherein a rotating distributor is placed in front of the wafer. The distributor is rotating by the flow of electrolyte through some of the holes that are drilled in an angle to the flow direction. The level of the electrolyte is maintained below the face of the wafer and slightly above the rotating distributor. The electrolyte emerges from the distributor in the form of multiple jets hitting the surface of the wafer. The jets also serve as the ionic path for the passage of current between the anode and the cathode. The jets ensure the uniformity and conformity of the electroplating process, in the presence or even in the absence of electroplating additives such as leveling agents and brighteners. Uniform or predetermined nonuniform distribution of electroplating can be achieved by uniform or nonuniform distribution of holes in the distributor, repectively.

9. An electroplating device for wafer metallization as set forth in claims 1, wherein the current is periodically reversed in order to remove excess electroplated metal from areas on the wafer where the electroplating is thicker than the average. The total electrical charge passed during the reversed current period must be smaller than the total charge passed during the forward current period.

10. An electroplating device for wafer metallization as set forth in claim 1, wherein pulsed current is applied during the electroplating process in order to achieve uniformity and conformity to the high aspect ratio trenches, holes and via which are patterned on the surface of the wafer.

11. An electroplating device for wafer metallization as set forth in claim 1 wherein the wafer is stationary and the whole electroplating apparatus is rotating.

12. An electroplating device for the metallization of wafers for interconnection. The wafer, previously coated with a thin barrier layer and a thin seed layer of the electroplated metal, is placed and pressed against contact pegs and rested on an insulating ring which masks the circumference edge of the wafer. The electrically conducting peg are insulated from the electrolyte by insulating sleeves, except at the points of contact with the wafer. The electrolyte is pumped upward against the wafer. One or multiple contact pegs are spatially distributed over the surface of the wafer in order to ensure uniform electroplating of the metal over the entire wafer. Feeding the electrical current from a contact to the center of the wafer and from various contact points ensure uniformity in the thickness of the electroplated metal layer.

13. An electroplating device for wafer metallization as set forth in claim 12, wherein the contact pegs assembly and the wafer are rotating together in order to ensure uniform plating.

14. An electroplating device for wafer metallization as set forth in claim 12, wherein the electrolyte is pumped upward against the wafer which is resting on the contact pegs and the insulating ring.

15. An electroplating device for wafer metallization as set forth in claim 12, wherein the contact pegs assembly and the wafer are rotating and the electrolyte is pumped upward against the rotating wafer, whose only active surface is exposed to the liquid while the back side is outside the electrolyte.

16. An electroplating device for wafer metallization as set forth in claims 12, wherein the current is periodically reversed in order to remove excess electroplated metal from areas on the wafer where the electroplating is thicker than the average. The total electrical charge passed during the reversed current period must be smaller than the total charge passed during the forward current period.

17. An electroplating device for wafer metallization as set forth in claim 12, wherein pulsed current is applied during the electroplating process in order to achieve uniformity and conformity to the high aspect ratio trenches, holes and via which are patterned on the surface of the wafer.

18. An electroplating device for wafer metallization as set forth in claim 12 wherein the wafer is stationary and the whole electroplating apparatus is rotating.

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